Claims

VOCAL CORD DETECTION

1. A method for detecting reflex vocal cord closure during delivery of airway pressure treatment comprising steps of:
delivering a controlled supply of breathable gas at a pressure above atmospheric to a patient;
deriving a measure indicative of a vocal cord closure in said patient; and
detecting an incident of vocal cord closure as a function of said measure.

2. The method of claim 1 wherein said measure is derived from respiratory airflow of the patient.

3. The method of claim 2 wherein said measure is a function of an estimate of a stage of sleep of the patient.

4. The method of claim 3 wherein said measure is a derived ventilation.

5. The method of claim 4 wherein said derived ventilation is a minute volume.

6. The method of claim 5 wherein said measure is a further function of elapsed time.

7. The method of claim 2 further wherein the step of detecting an incident of vocal cord closure comprises the sub-steps of:
detecting airway obstruction from respiratory airflow of the patient; and
comparing said measure to one or more thresholds.

8. The method of claim 7 wherein one of said thresholds is an elapsed time and one of said thresholds is a measure of ventilation.

9. The method of claim 7 followed by the steps of (a) increasing said controlled supply of breathable gas if vocal cord closure is not detected and (b) maintaining or decreasing said controlled supply of breathable gas if vocal cord closure is detected.

10. The method of claim 8 wherein said measure of ventilation is about 12 liters per minute averaged over a previous period of time of about five minutes, and wherein said elapsed time is about 30 minutes.

11. The method of claim 1 wherein the step of detecting an incident of vocal cord closure comprises the sub-steps of:
detecting airway obstruction in the patient; and
comparing said measure indicative of a vocal cord closure to at least one threshold.

12. The method of claim 11 wherein the step of detecting determines obstruction from a measure of minute ventilation in relation to a change in the pressure of the breathable gas.

13. The method of claim 11 wherein the measure indicative of a vocal cord closure is an elapsed period of time.

14. The method of claim 13 wherein the at least one threshold is about 30 minutes.

15. The method of claim 1 wherein the step of detecting an incident of vocal cord closure comprises distinguishing an incident of vocal cord closure from another type of airway obstruction based on said measure.

16. The method of claim 15 wherein the step of distinguishing comprises the sub-steps of:
detecting an obstructive event in said patient; and
conditioning an increase in the pressure of the breathable gas in response to the detected obstructive event by an analysis of said measure.

17. The method of claim 16 wherein said analysis comprises a comparison of said measure with a time limit.

18. The method of claim 17 wherein said time limit is about 30 minutes.

19. An apparatus for detecting reflex vocal cord closure during delivery of airway pressure treatment comprising:
a mask;
a controllable blower to supply breathable gas at a pressure above atmospheric to said mask;
a flow sensor to generate a flow signal indicative of the patient's airflow; and
a processor to process said flow signal and control said blower wherein said processor is programmed with instructions to control the steps of:

adjusting the pressure of the breathable gas;
deriving a measure indicative of a vocal cord closure in said patient; and
detecting an incident of vocal cord closure as a function of said measure.

20. The apparatus of claim 19 wherein said measure is derived from respiratory airflow of the patient.

21. The apparatus of claim 20 wherein said measure is an estimate of a stage of sleep of the patient.

22. The apparatus of claim 21 wherein said measure is a determined ventilation.

23. The apparatus of claim 22 wherein said determined ventilation is a minute volume.

24. The apparatus of claim 23 wherein said measure is a further function of elapsed time.

25. The apparatus of claim 19 wherein said processor is programmed with instructions to control (a) increasing said pressure if vocal cord closure is not detected, and (b) maintaining or decreasing said pressure if vocal cord closure is detected.

26. The apparatus of claim 19 wherein the step of detecting an incident of vocal cord closure comprises the sub-steps of:
detecting airway obstruction in the patient; and
comparing said measure indicative of a vocal cord closure to at least one threshold.

27. The apparatus of claim 26 wherein the step of detecting airway obstruction determines obstruction from a measure of minute ventilation in relation to a change in pressure of the breathable gas.

28. The apparatus of claim 26 wherein the measure indicative of a vocal cord closure is an elapsed period of time.

29. The apparatus of claim 28 wherein the at least one threshold is about 30 minutes.

30. The apparatus of claim 19 wherein the step of detecting an incident of vocal cord closure comprises distinguishing an incident of vocal cord closure from another type of airway obstruction based on said measure.

31. The apparatus of claim 30 wherein the step of distinguishing comprises the sub-steps of:
detecting an obstructive event in said patient; and
conditioning an increase in the pressure of the breathable gas in response to the detected obstructive event by an analysis of said measure.

32. The apparatus of claim 31 wherein said analysis comprises a comparison of said measure with a time limit.

33. The apparatus of claim 32 wherein said time limit is about 30 minutes.

34. An apparatus for detecting reflex vocal cord closure during delivery of airway pressure treatment comprising:
a means for delivering to a patient a controlled supply of breathable gas at a pressure above atmospheric;
a flow sensor to generate a flow signal indicative of the patient's airflow; and
a control means to process said flow signal and control said means for delivering wherein said control means is configured for:

controlling said means for delivering;

deriving a measure indicative of a vocal cord closure in said patient; and

detecting an incident of vocal cord closure as a function of said measure.

35. The apparatus of claim 34 further wherein detecting an incident of vocal cord closure comprises the sub-steps of:
detecting airway obstruction by analysis of data from said flow signal; and
comparing said measure to one or more thresholds.

36. The apparatus of claim 35 wherein one of said thresholds is an elapsed time and one of said thresholds is a measure of ventilation.

37. The apparatus of claim 36 wherein said measure of ventilation is about 12 liters per minute averaged over a previous period of time of about five minutes, and wherein said elapsed time is about 30 minutes.

38. The apparatus of claim 34 wherein said control means is configured for (a) increasing said controlled supply of breathable gas if vocal cord closure is not detected and (b) maintaining or decreasing said controlled supply of breathable gas if vocal cord closure is detected.

39. The apparatus of claim 34 wherein the step of detecting an incident of vocal cord closure comprises the sub-steps of:
detecting airway obstruction in the patient; and
comparing said measure indicative of a vocal cord closure to at least one threshold.

40. The apparatus of claim 39 wherein the step of detecting airway obstruction determines obstruction from a measure of minute ventilation in relation to a change in pressure of the breathable gas.

41. The apparatus of claim 39 wherein the measure indicative of a vocal cord closure is an elapsed period of time.

42. The apparatus of claim 41 wherein the at least one threshold is about 30 minutes.

43. The apparatus of claim 34 wherein the step of detecting an incident of vocal cord closure comprises distinguishing an incident of vocal cord closure from another type of airway obstruction based on said measure.

44. The apparatus of claim 43 wherein the step of distinguishing comprises the sub-steps of:
detecting an obstructive event in said patient; and
conditioning an increase in the pressure of the breathable gas in response to the detected obstructive event by an analysis of said measure.

45. The apparatus of claim 44 wherein said analysis comprises a comparison of said measure with a time limit.

46. The apparatus of claim 45 wherein said time limit is about 30 minutes.

POSITIVE PRESSURE DOSE

47. A method for assessing the treatment of a heart failure patient receiving positive airway pressure comprising steps of:

delivering a supply of breathable gas at a pressure above atmospheric to an airway of a patient;

controlling said supply of breathable gas at a treatment pressure to perform work of the heart of the patient; and

determining a heart treatment index representative of a dose of heart treatment experienced by the patient's heart as a function of duration of the treatment and a function of said treatment pressure.

48. The method of claim 47 wherein said duration excludes time periods of airway obstruction when pressure is not delivered to the heart.

49. The method of claim 48 wherein said function of pressure is an average pressure.

50. The method of claim 49 wherein said index is a product of said duration and said average.

51. The method of claim 47 further comprising step of administering said supply of breathable gas by comparing said index to a predetermined threshold and generating a response when said comparing indicates that said index has satisfied said predetermined threshold.

52. The method of claim 51 wherein said response ceases the delivery of said amplitude.

53. The method of claim 52 wherein said response comprises a message of compliance with the predetermined threshold.

54. An apparatus for treating heart failure patients comprising:

a means for delivering a supply of breathable gas at a pressure above atmospheric to a patient;

a pressure means to generate a treatment pressure signal representing pressure delivered to the patient; and

a control means to process said treatment pressure signal, said control means configured for determining a heart treatment index representative of a dose of heart treatment experienced by the patient's heart as a function of duration of the heart treatment and a function of the treatment pressure.

55. The apparatus of claim 54 further comprising a flow sensor configured to transfer a flow signal to the control means, wherein the control means is further configured for determining said

duration to exclude time periods of airway obstruction when treatment is not delivered to the heart.

56. The apparatus of claim 55 wherein said function of pressure is an average.

57. The apparatus of claim 56 wherein said index is a product of said duration and said average.

58. The apparatus of claim 54 wherein the control means is further configured for administering said supply of breathable gas by comparing said index to a prescribed threshold and generating a response when said comparing indicates that said index has satisfied said prescribed threshold.

59. The apparatus of claim 58 wherein said response ceases the delivery of said amplitude.

60. The apparatus of claim 59 wherein said response is an informing signal that identifies compliance with the prescribed threshold.

61. An apparatus for treating heart failure patients comprising:
a mask;
a controllable blower to supply breathable gas at a pressure above atmospheric to said mask;
a pressure transducer to generate a mask pressure signal indicative of the pressure in the mask; and
a processor to evaluate said mask pressure signal and control said blower wherein said processor is programmed with control instructions for controlling:
delivery of said supply of breathable gas at a pressure to perform work of the heart of the patient; and
determining a heart treatment index representative of a dose of heart treatment experienced by the patient's heart as a function of duration of the treatment and a function of said pressure.

62. The apparatus of claim 61 further comprising a flow sensor configured to transfer a flow signal to the processor, wherein said control instructions determine said duration to exclude time periods associated with airway obstruction when treatment is not delivered to the heart.

63. The apparatus of claim 62 wherein said function of pressure is an average.

64. The apparatus of claim 63 wherein said index is a product of said duration and said average.

65. The apparatus of claim 64 wherein said processor further includes control instructions for administering said supply of breathable gas by comparing said index to a predetermined

threshold and generating a response when said comparing indicates that said index has met or exceeded said predetermined threshold.

66. The apparatus of claim 65 wherein said response ceases the delivery of said amplitude.

67. The apparatus of claim 66 wherein said response is a message signal that communicates to a user that compliance with the prescribed threshold has been accomplished.

CARDIAC PRESSURE OSCILLATIONS

68. A method for treating heart failure patients comprising steps of:
delivering a supply of breathable gas at a pressure above atmospheric to the airway of a patient;
detecting a cardiac rhythm of the patient;
generating a cardiac pressure waveform synchronized with said cardiac rhythm to aid the patient's heart wherein an amplitude of said synchronized cardiac pressure waveform is timed to increase during a systolic phase of the heart and decrease during a diastolic phase of the heart;
generating a respiratory pressure to provide pressure support to the airway of the patient; and
controlling said supply of breathable gas to include said synchronized cardiac pressure waveform superimposed with said respiratory pressure.

69. The method of claim 68 wherein said synchronized cardiac pressure waveform comprises a repeated square wave.

70. The method of claim 69 wherein said respiratory pressure comprises a positive airway pressure treatment varied with a respiratory cycle of the patient to provide bi-level support.

71. The method of claim 69 wherein said respiratory pressure comprises a smooth pressure wave varied as a function of respiratory airflow.

72. The method of claim 68 wherein said synchronized cardiac pressure waveform comprises a sinusoidal wave.

73. The method of claim 72 wherein said respiratory pressure comprises a positive airway pressure treatment varied with a respiratory cycle of the patient to provide bi-level support.

74. The method of claim 72 wherein said respiratory pressure comprises a smooth pressure wave varied as a function of respiratory airflow.

75. The method of claim 68 wherein an amplitude of said synchronized cardiac pressure waveform is in a range of about 1 to 4 cm H_2O.

76. An apparatus for treating heart failure patients comprising:
a means for delivering a supply of breathable gas at a pressure above atmospheric to a patient;
a cardiac sensor means to generate a cardiac rhythm signal indicative of a cardiac rhythm of the

patient;

a flow sensor means to generate a flow signal indicative of respiratory airflow of the patient; and

a control means to (a) process said cardiac rhythm signal and said flow signal and (b) control said means for delivering wherein said control means is configured with instructions for:

generating a synchronized cardiac pressure waveform with said cardiac rhythm to perform work of the heart of the patient wherein an amplitude of said synchronized cardiac pressure waveform is timed to increase during a systolic phase of the heart and decrease during a diastolic phase of the heart;

generating a level of respiratory pressure to provide pressure support to the airway of the patient; and

controlling said means for delivering to provide said supply of breathable gas to include said synchronized cardiac pressure waveform superimposed with said level of respiratory pressure.

77. The apparatus of claim 76 wherein said synchronized cardiac pressure waveform comprises a repeated square wave.

78. The apparatus of claim 77 wherein said level of respiratory pressure comprises a positive airway pressure treatment varied with a respiratory cycle of the patient to provide bi-level support.

79. The apparatus of claim 77 wherein said level of respiratory pressure comprises a smooth pressure wave varied as a function of respiratory airflow.

80. The apparatus of claim 76 wherein said synchronized cardiac pressure waveform comprises a sinusoidal wave.

81. The apparatus of claim 80 wherein said level of respiratory pressure comprises a positive airway pressure treatment varied with a respiratory cycle of the patient to provide bi-level support.

82. The apparatus of claim 80 wherein said level of respiratory pressure comprises a smooth pressure wave varied as a function of respiratory airflow.

83. The apparatus of claim 76 wherein an amplitude of said synchronized cardiac pressure waveform is in a range of about 1 to 4 cm H_2O.

84. An apparatus for treating heart failure patients comprising:

a mask;

a controllable blower to supply breathable gas at a pressure above atmospheric to said mask;

a set of electrodes to detect a cardiac rhythm signal indicative of a cardiac rhythm of the patient;
a pressure transducer to generate a flow signal indicative of the patient's airflow; and
a processor to (a) evaluate said cardiac rhythm signal and said flow signal and (b) control said blower wherein said processor is programmed with instructions for:

generating a synchronized cardiac pressure waveform with said cardiac rhythm to perform work of the heart of the patient wherein an amplitude of said synchronized cardiac pressure waveform is timed to increase during a systolic phase of the heart and decrease during a diastolic phase of the heart;

generating a level of respiratory pressure to provide pressure support to the airway of the patient; and

controlling said blower to provide said supply of breathable gas to include said synchronized cardiac pressure waveform superimposed with said level of respiratory pressure.

85. The apparatus of claim 84 wherein said synchronized cardiac pressure waveform comprises a repeated square wave.

86. The apparatus of claim 85 wherein said level of respiratory pressure comprises a positive airway pressure treatment varied with a respiratory cycle of the patient to provide bi-level support.

87. The apparatus of claim 85 wherein said level of respiratory pressure comprises a smooth pressure wave varied as a function of respiratory airflow.

88. The apparatus of claim 84 wherein said synchronized cardiac pressure waveform comprises a sinusoidal wave.

89. The apparatus of claim 88 wherein said level of respiratory pressure comprises a positive airway pressure treatment varied with a respiratory cycle of the patient to provide bi-level support.

90. The apparatus of claim 88 wherein said level of respiratory pressure comprises a smooth pressure wave varied as a function of respiratory airflow.

91. The apparatus of claim 84 wherein an amplitude of said synchronized cardiac pressure waveform is in a range of about 1 to 2 cm H_2O.

HEART FAILURE INDICATOR

92. A method for evaluating heart failure in a patient comprising steps of:
delivering breathable gas at a pressure above atmospheric to a patient;

measuring airflow of the patient; and

calculating a heart failure indicator from said airflow, said heart failure indicator representing information about the patient's heart condition.

93. The method of claim 92 wherein said step of calculating includes analyzing said airflow to determine an extent of Cheyne-Stokes breathing of the subject.

94. The method of claim 93 further comprising steps of prompting for heart failure monitoring characteristics and recording said heart failure monitoring characteristics and said heart failure indicator in a database.

95. The method of claim 94 wherein one of said heart failure monitoring characteristics is a level of B natriuretic peptide.

96. The method of claim 93 further comprising a step of identifying subsequent heart failure treatment based at least in part upon said heart failure indicator.

97. The method of claim 96 wherein said subsequent heart failure treatment is an increase in pressure of the breathable gas.

98. The method of claim 93 further comprising the step of comparing said heart failure indicator to a prior heart failure indicator determined during a previous treatment session.

99. The method of claim 93 further comprising the step of reducing said pressure during a detected episode of Cheyne-Stokes breathing for a predetermined period of time to permit a determination of said heart failure indicator from said predetermined period of time such that a pattern of Cheyne-Stokes breathing can emerge without significant influence from treatment pressure.

100. The method of claim 93 wherein said step of calculating includes analyzing said airflow to determine a duration of a waxing and waning cycle.

101. The method of claim 100 further comprising the step of analyzing said heart failure indicator as a function of a threshold value.

102. The method of claim 100 wherein said indicator is a function of a measure of ventilation.

103. The method of claim 100 further comprising a step of analyzing said heart failure indicator to determine a change in said heart failure indicator over time.

104. The method of claim 103 wherein said change is a difference between a previous heart failure indicator and a subsequent heart failure indicator.

105. The method of claim 103 wherein said change is a ratio of a previous heart failure indicator and a subsequent heart failure indicator.

106. The method of claim 103 further comprising a step of generating a warning as a function of said change from said step of analyzing.

107. The method of claim 106 wherein said warning is an audible alarm.

108. The method of claim 93 wherein said step of calculating includes a frequency analysis of said airflow in a range of frequencies indicative of Cheyne-Stokes breathing.

109. The method of claim 108 wherein said frequency analysis of said airflow is in a range of about 1/20 hertz to 1/90 hertz.

110. The method of claim 109 wherein said heart failure indicator includes a magnitude of a component of said airflow at a frequency in said range.

111. The method of claim 110 wherein said heart failure indicator is a sum of magnitudes of components of said airflow in a sub-range of frequencies in said range.

112. The method of claim 111 wherein said frequency analysis of said airflow is performed with data sampled from a measure of ventilation derived from said airflow.

113. The method of claim 112 wherein said measure of ventilation is a minute volume.

114. The method of claim 110 further comprising a step of comparing said magnitude with a threshold value.

115. The method of claim 114 wherein said threshold value is a magnitude derived from a previous frequency analysis.

116. The method of claim 93 wherein said indicator is a measure of ventilation.

117. The method of claim 116 wherein said measure of ventilation is a threshold of about 15 L/min.

118. The method of claim 93 wherein said indicator is a ratio of a minimum ventilation and a maximum ventilation.

119. The method of claim 118 wherein the minimum ventilation and maximum ventilation are derived from a measure of minute ventilation.

120. The method of claim 118 wherein the minimum ventilation and maximum ventilation are derived from a measure of tidal volume.

121. An apparatus for evaluation of heart failure in a patient comprising:
a means for supplying a controllable level of breathable gas to a patient at a pressure above atmospheric;
a flow sensor to generate a flow signal indicative of the patient's airflow; and
a controller to process said flow signal and control said means for supplying wherein said controller is adapted and configured for:

delivering breathable gas at a pressure above atmospheric to a patient with said means for supplying; and

calculating a heart failure indicator from said flow signal, said heart failure indicator representing information about the patient's condition.

122. The apparatus of claim 121wherein said calculating includes analyzing said airflow to determine an extent of Cheyne-Stokes breathing of the subject.

123. The apparatus of claim 122 wherein the controller is further configured and adapted for prompting for heart failure monitoring characteristics and recording said heart failure monitoring characteristics and said heart failure indicator in a memory.

124. The apparatus of claim 123 wherein one of said heart failure monitoring characteristics is a level of B natriuretic peptide.

125. The apparatus of claim 122 wherein the controller is further configured and adapted for controlling a step of identifying subsequent heart failure treatment based at least in part upon said heart failure indicator.

126. The apparatus of claim 125 wherein said subsequent heart failure treatment is an increase in the pressure of the breathable gas.

127. The apparatus of claim 122 wherein the controller is further configured and adapted for controlling comparing said heart failure indicator to a prior heart failure indicator determined during a previous treatment session.

128. The apparatus of claim 122 wherein the controller is further configured and adapted for reducing said pressure during a detected episode of Cheyne-Stokes breathing for a predetermined period of time to permit a determination of said heart failure indicator from said predetermined period of time such that a pattern of Cheyne-Stokes breathing can emerge without significant influence from treatment pressure.

129. The apparatus of claim 122 wherein said calculating comprises analyzing said airflow to determine a duration of a waxing and waning cycle.

130. The apparatus of claim 125 wherein said controller is further configured and adapted for analyzing said heart failure indicator as a function of a threshold value.

131. The apparatus of claim 125 wherein said indicator is a function of a measure of ventilation.

132. The apparatus of claim 125 wherein said controller is further configured and adapted for analyzing said heart failure indicator to determine a change in said heart failure indicator over time.

133. The apparatus of claim 128 wherein said change is a difference between a previous heart failure indicator and a subsequent heart failure indicator.

134. The apparatus of claim 128 wherein said change is a ratio of a previous heart failure indicator and a subsequent heart failure indicator.

135. The apparatus of claim 128 wherein said controller is further configured and adapted for generating a warning signal as a function of said change from said step of analyzing.

136. The apparatus of claim 135 wherein said warning signal triggers an audible alarm in said device.

137. The apparatus of claim 122 wherein said calculating comprises a frequency analysis of said airflow in a range of frequencies indicative of Cheyne-Stokes breathing cycle.

138. The apparatus of claim 137 wherein said frequency analysis of said airflow is in a range of about 1/20 hertz to 1/90 hertz.

139. The apparatus of claim 138 wherein said heart failure indicator includes a magnitude of a component of said airflow at a frequency in said range.

140. The apparatus of claim 139 wherein said heart failure indicator is a sum of magnitudes of components of said airflow in a sub-range of frequencies in said range.

141. The apparatus of claim 140 wherein said frequency analysis of said airflow is performed with data sampled from a measure of ventilation derived from said airflow.

142. The apparatus of claim 141 wherein said measure of ventilation is a minute volume.

143. The apparatus of claim 139 with further instructions for controlling a step of comparing said magnitude with a threshold value.

144. The apparatus of claim 143 wherein said threshold value is a magnitude derived from a previous frequency analysis.

145. The apparatus of claim 122 wherein said indicator is a measure of ventilation.

146. The apparatus of claim 145 wherein said measure of ventilation is a threshold of about 15 L/min.

147. The apparatus of claim 122 wherein said indicator is a ratio of a minimum ventilation and a maximum ventilation.

148. The apparatus of claim 147 wherein the minimum ventilation and maximum ventilation are derived from a measure of minute ventilation.

149. The apparatus of claim 147 wherein the minimum ventilation and maximum ventilation are derived from a measure of tidal volume.

150. An apparatus for treating a patient with heart failure comprising:
a mask for providing a sealable connection with a patient's airway;
a blower configured for supplying a controllable level of breathable gas to the mask at a pressure above atmospheric;
a differential pressure transducer configured to generate a flow signal representative of the patient's airflow; and
a processor configured to receive said flow signal and control said level of breathable gas;
wherein said apparatus comprises programmed control instructions to control (a) a determination of a condition of the patient's heart indicative of a degree of heart failure from said flow signal, and (b) a selection of a treatment pressure delivered to said mask.

151. The apparatus of claim 150 wherein said determination evaluates an extent of Cheyne-Stokes breathing of said patient.

152. The apparatus of claim 150 further comprising programmed control instructions that prompt for heart failure monitoring characteristics and record said heart failure monitoring characteristics and said heart failure indicator in a memory.

153. The apparatus of claim 152 wherein one of said heart failure monitoring characteristics is a level of B natriuretic peptide.

154. The apparatus of claim 150 further comprising programmed control instructions that select subsequent heart failure treatment based at least in part upon said heart failure indicator.

155. The apparatus of claim 154 wherein said subsequent heart failure treatment is an increase in pressure.

156. The apparatus of claim 151 further comprising programmed control instructions that compare said heart failure indicator to a prior heart failure indicator determined during a previous treatment session.

157. The apparatus of claim 151 further comprising programmed control instructions that reduce said pressure during a detected episode of Cheyne-Stokes breathing for a predetermined period of time to permit a determination of said heart failure indicator from said predetermined period of time such that a pattern of Cheyne-Stokes breathing can emerge without significant influence from treatment pressure.

158. The apparatus of claim 151 wherein said calculating comprises analyzing said airflow to determine a duration of a waxing and waning cycle.

159. The apparatus of claim 158 further comprising programmed control instructions that analyze said heart failure indicator as a function of a threshold value.

160. The apparatus of claim 158 wherein said indicator is a function of a measure of ventilation.

161. The apparatus of claim 159 further comprising programmed control instructions that analyze said heart failure indicator to determine a change in said heart failure indicator over time.

162. The apparatus of claim 161 wherein said change is a difference between a previous heart failure indicator and a subsequent heart failure indicator.

163. The apparatus of claim 161 wherein said change is a ratio of a previous heart failure indicator and a subsequent heart failure indicator.

164. The apparatus of claim 161 further comprising programmed control instructions that generate a warning signal as a function of said change.

165. The apparatus of claim 164 wherein said warning signal triggers an audible alarm in said device.

166. The apparatus of claim 151 wherein said determination comprises a frequency analysis of said airflow in a range of frequencies indicative of Cheyne-Stokes breathing.

167. The apparatus of claim 166 wherein said frequency analysis of said airflow is in a range of about 1/20 hertz to 1/90 hertz.

168. The apparatus of claim 167 wherein said heart failure indicator comprises a magnitude of a component of said airflow at a frequency in said range.

169. The apparatus of claim 168 wherein said heart failure indicator is a sum of magnitudes of components of said airflow in a sub-range of frequencies in said range.

170. The apparatus of claim 169 wherein said frequency analysis of said airflow is performed with data sampled from a measure of ventilation derived from said airflow.

171. The apparatus of claim 170 wherein said measure of ventilation is a minute volume.

172. The apparatus of claim 168 with further instructions that compare said magnitude with a threshold value.

173. The apparatus of claim 172 wherein said threshold value is a magnitude derived from a previous frequency analysis.

174. The apparatus of claim 151 wherein said indicator is a measure of ventilation.

175. The apparatus of claim 174 wherein said measure of ventilation is a threshold of about 15 L/min.

176. The apparatus of claim 151 wherein said indicator is a ratio of a minimum ventilation and a maximum ventilation.

177. The apparatus of claim 176 wherein the minimum ventilation and maximum ventilation are derived from a measure of minute ventilation.

178. The apparatus of claim 176 wherein the minimum ventilation and maximum ventilation are derived from a measure of tidal volume.